ZooKeys 1277: 79–100 (2026)
DOI: 10.3897/zookeys.1277.156127

Review Article

Phylum Rotifera in Peru: a review of studies on biodiversity and annotated checklist of taxa

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Abstract

Peru is a megadiverse country, home to some of the world's most important biodiversity hotspots. This paper systematically reviews published studies on the phylum Rotifera in Peru, aiming to identify key features, knowledge gaps, and research challenges, thereby contributing to the conservation of rotifers. A brief history of rotifer studies is presented, and the first annotated checklist is provided of all rotifer taxa recorded according to their most recent taxonomic status, valid nomenclature, and department distribution. The number of studies on Peruvian rotifer fauna is limited, with only 35 publications. These papers are primarily in the Spanish language and are published in national journals. Ecological studies, often conducted on a short-term basis, frequently dominate classical taxonomic works. Additionally, many departments and types of freshwater environments in the country remain understudied. To date, 203 valid rotifer species have been recorded. This number is unrepresentative, as more than half of the departments lack documented records. Most recorded rotifer species in Peru are from freshwater habitats in the eastern of the country, particularly near the Amazon Basin. Several important gaps are highlighted, including the need for precise revision of existing records, promoting taxonomic harmonization, and enhancing sampling efforts.

Key words: Neotropics, Peruvian Amazonia, rotifers, South America, Tropical Andes, zooplankton diversity

OPEN ACCESS

Academic editor: Pavel Stoev
Received: 22 April 2025
Accepted: 2 October 2025
Published: 9 April 2026

ZooBank: https://zoobank.org/AAF45DD2-B23A-427A-94CC-69EC89FE9617

Citation: Rojas-Baez E, Samanez I, Soto LM, Pardo MJ, Karpowicz M, Michaloudi E, Stamou G, de Los Ríos-Escalante PR, López C (2026) Phylum Rotifera in Peru: a review of studies on biodiversity and annotated checklist of taxa. ZooKeys 1277: 79-100. https://doi.org/10.3897/zookeys.1277.156127

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Introduction

The phylum Rotifera, commonly known as rotifers, comprises a group of small organisms (body size 50–2,000 µm) and includes approximately 2,030 species distributed worldwide (Segers 2007; Wallace and Snell 2010). Rotifers

possess various mechanisms, including the capacity to enter a dormant or resting phase, which enables survival and resistance to environmental conditions in diverse aquatic (mostly freshwater) or limnoterrestrial habitats (macrophytes, psammon, mosses, lichens, and phytotelmata) (Fontaneto and De Smet 2015). They play a crucial role in the aquatic food web (Wallace and Snell 2010; Gilbert 2022), and several species are widely used as model organisms and biological tools (Declerck and Papakostas 2017; Serra and Fontaneto 2017; Rico-Martínez et al. 2017; Won et al. 2017; Hagiwara and Marcial 2019; Gribble 2021; Shaleh et al. 2024).

Like other microscopic organisms that historically have been understudied (Vicente 2010; Anthony et al. 2023), the biodiversity of rotifer species across many regions worldwide remains largely unrecognized (Fontaneto et al. 2006; Segers 2007, 2008). Particularly in the Neotropics, the enormous environmental heterogeneity has facilitated Rotifera to become one of the most speciose groups of inland waters zooplankton (Andrade-Sossa et al. 2023; Castilho-Noll et al. 2023; Duré et al. 2023; González et al. 2023; López et al. 2023). However, our knowledge about Neotropical rotifers is still dispersed and limited, especially concerning the tropical Andes region and eastern Amazon, where many threats promote habitat destruction and biodiversity losses (Asner et al. 2017; Sánchez-Cuervo et al. 2020; Campero et al. 2024). Recent studies from these countries have begun to establish a solid foundation for advancing rotifer research through reviews, updated checklists, and species distribution records (López et al. 2020; Andrade-Sossa et al. 2023; Elmoor-Loureiro et al. 2023; González et al. 2023; López et al. 2023; Fernández et al. 2024).

Peru is one of the 17 megadiverse countries (Fajardo et al. 2014) and covers two important biodiversity zones: the Tropical Andes and the Tumbes-Chocó-Magdalena hotspot (Noss 1990; Myers 1988). Peru is also characterized by extreme topographic complexity, with the arid Pacific coast, the high Andes, and the Amazon basin, as well as marked climatic diversity ranging from tropical to temperate to arid conditions (Myers 1988). The National System of Natural Protected Areas by the Peruvian State represents ~15.2% of the country, to conserve a representative sample of its biodiversity. Nevertheless, important gaps in conservation coverage have been identified, so a review and expansion of the system is required (Fajardo et al. 2014). Priority areas for conservation are primarily determined based on expert criteria, with emphasis on regions of diversity and endemism (Rodríguez and Young 2000), as has been documented for certain organism groups and marine biodiversity (Angulo 2009; Fernandez-Baca et al. 2007). However, as in many other countries, freshwater biodiversity — particularly that of small organisms, such as protozoa, rotifers, and microcrustaceans, which constitute the core of freshwater zooplankton — remains largely unknown and underestimated. Consequently, these groups are rarely considered in research and conservation policies (Cuesta et al. 2017; Oliveira et al. 2017; Bax and Francesconi 2019; Mendoza-Ponce et al. 2020; Kleemann et al. 2022).

Here, we conducted a systematic literature review to analyze studies published on Peruvian rotifers, identifying their main features. We also provide a brief historical overview and present the first annotated checklist of all rotifer

taxa recorded in Peru, based on their most recent taxonomic status, valid nomenclature, and distribution. This work aims to identify knowledge gaps and research challenges and to contribute to the conservation of their biodiversity.

Methods

The present work is based on a systematic review of scientific publications reporting rotifer species in Peru. A literature search was conducted using keywords "Rotifer," "Rotifers," "Rotifera" and "Peru" in both English and Spanish across databases including Web of Science, Zoological Record, Scopus, Scielo and Google Scholar. The digital search was supplemented with scientific articles in printed form (old papers, not digitalized) and the articles cited in reviewed articles (Duré et al. 2023).

Only studies on rotifers done inside the Peruvian territory and/or using rotifer species or strains originating from these were considered for analysis. Only 35 publications were considered for baseline data analysis. Based on this baseline data (Suppl. material 1), a brief history of studies and a bibliometric analysis were conducted. A graphical representation of publications over the years provides evidence of the time trends. We categorized the publications according to the language used, the institutions involved (national, international, or both), and the publication type (journal papers, book chapters, and books) using titles and abstracts of the publications. Each publication was assigned to only one category. Additionally, based on the review of the publication texts, we categorized the topics (field ecology, experimental ecology, or taxonomy), the administrative divisions (departments), the types of environments studied (e.g., lakes, lagoons, ponds, reservoirs, wetlands, rivers, and other artificial habitats), and whether the studies focused on the entire zooplankton assemblage or exclusively on rotifers. For the ecological studies, features such as the ecological level (individual, population, community) and duration: short (< 5 years) or long-term (> 5 years), were highlighted according to Castilho-Noll et al. (2023). All graphics were generated using the "ggplot2" package in R v. 4.4.1.

For the checklist, we reviewed the full text of all papers, including those from non-indexed journals, to exclude genus-level identifications. Reports from studies with a doubtful rotifer species identification process, involving species classified as species inquirenda, absence of information on the department or place of origin were not considered in the elaboration of the annotated checklist (See Suppl. material 1). The taxonomic status and ranges of rotifer species were identified using the Rotifer World Catalog (Jersabek and Leitner 2013). Species names, authorship, synonyms, and spellings were verified and updated according to the recent List of Available Names (**LAN**) (Jersabek et al. 2018a, 2018b; Segers et al. 2012). The records were assigned based on the political territorial division of Peru at the department level, considering the Constitutional province of Callao as a department. An overview of the number of rotifer species recorded across different departments is illustrated in a map created using QGIS software v. 3.28.1. Species with distribution and reported for the Neotropical region were analyzed using information from the Rotifer World Catalog (**RWC**) (Jersabek and Leitner 2013) and Segers (2007).

Results

Brief history

The study of rotifers in Peru dates back to the mid-19th century, beginning with the description of *Polyarthra hexaptera* Schmarda, 1859; currently a species inquirenda (Jersabek et al. 2018b) reported by Schmarda (1859) after a global expedition. Subsequent reports on rotifer species were part of invertebrate surveys conducted in the Andean departments of southwestern Peru, particularly in and around Lake Titicaca (Murray and Wailes 1913; De Beauchamp 1939; Thomasson 1956; Richerson et al. 1977). A re-evaluation of some of these previous studies reporting *Notholca foliacea* (Ehrenberg, 1838) (Murray and Wailes 1913; De Beauchamp, 1939) was conducted based on additional literature (Hollowday and Hussey 1989). Subsequently, several studies described the rotifer diversity in freshwater habitats from the Peruvian Amazon and central high Andean lakes (Koste 1988; Samanez 1988, 1991; Zambrano and Burger 1992; Samanez and Riofrío 1995; Samanez and Zambrano 1995).

During the past two decades, rotifers reports have frequently been incorporated in limnological characterizations of inland waterbodies (Riofrío et al. 2003; Ortega et al. 2006), and ecological studies of zooplankton communities (Iannacone and Alvariño 2006; Iannacone et al. 2013a; Chávez-Veintemilla et al. 2020; Flores 2022), with some studies primarily focusing on wetlands within the central coastal desert (Iannacone and Alvariño 2007a, b; Paredes et al. 2007; Iannacone et al. 2013b; Toscano and Severino 2013; Cepeda et al. 2018). Other research has employed advanced techniques to examine the resistance and revival of rotifers from extreme environments in the southern Peruvian Andes (Schmidt et al. 2017), and a recent study has further enhanced our understanding of the rotifer community in this region, offering new records and insights for the fauna of Peru (Karpowicz et al. 2025).

Additionally, research on native rotifer strains has explored their potential as bioindicators (Alayo and Iannacone 2002; Osorio et al. 2022) and their applications in local aquaculture (Alayo and Iannacone 2001; Cisneros 2011; Murrieta-Morey et al. 2015; Huanacuni-Pilco and Espinoza-Ramos 2019; Aguilar-Samanamud et al. 2022; Ismiño-Orbe et al. 2022). Moreover, the only study conducted at the national level that employed an integrative approach—combining molecular, morphological, and physiological aspects— was focused on the *Brachionus plicatilis* Müller, 1786 species complex from desert environments in Peru, leading to the identification of new subspecies, *B. paranguensis ventanillensis* and *B. koreanus santodomingensis*, both described by Sánchez-Dávila et al. (2021).

Bibliometric analysis

The bibliometric analysis focused on 35 publications (Suppl. material 1). The graphical representation of publications over time covers the period from 1859 to 2025. The earliest records dates back to 1859, but between that year and 1977, only five publications appeared, indicating very sporadic research activity. From the mid-20th century until the late 1980s and early 1990s, the mean frequency of publications was approximately one every 20 years. After this period, the frequency increased to an average of one publication every four years. For the last two decades, a clear upward trend is evident, with publications appear-

ing roughly every two years since 2013. Thus, a marked growth in rotifer-related research has been observed in recent decades (Fig. 1).

Most publications were written in Spanish, with fewer written in English, and a few papers in German and French (Fig. 2A). Most of this literature has been authored by researchers affiliated with Peruvian institutions, whose contributions first emerged in the late 1980s and have shown an increasing trend in recent years. In contrast, international researchers represent a small proportion and were the primary contributors until the late 1970s. During the last decade, only two studies have involved collaboration between Peruvian and international researchers (Fig. 2B). Most of the publications appeared in national journals, with one book and a single book chapter comprising the remainder (Fig. 2C).

The primary topics addressed in publications, in descending order of representation were field ecology (19), experimental ecology (9), and taxonomy (7). Most of these studies were based on samplings from natural inland water bodies, such as lakes, ponds, and rivers, while wetlands, reservoirs, and lagoons were mentioned less frequently. Additionally, various types of artificial environments, including fish farms, water intakes, water channels, aquaculture hatcheries, and cattle watering holes, were also referenced. No publications on limnoterrestrial habitats were found.

The review covers 12 department regions of Peru, with Lima and Puno standing out due to having the highest number of publications, nine and seven, respectively. These are followed by departments with two to five publications, such as Loreto, Ucayali, Huánuco, Junín, Callao, and Cusco. In contrast, regions like Ica, Madre de Dios, Tacna, and Piura are represented by only one publication each. Overall, 14 publications focused on lowland systems indicating modest predominance of research in Amazonian and coastal waterbodies, while 12 addressed highland systems, showing that Andean lakes and rivers also received considerable attention.

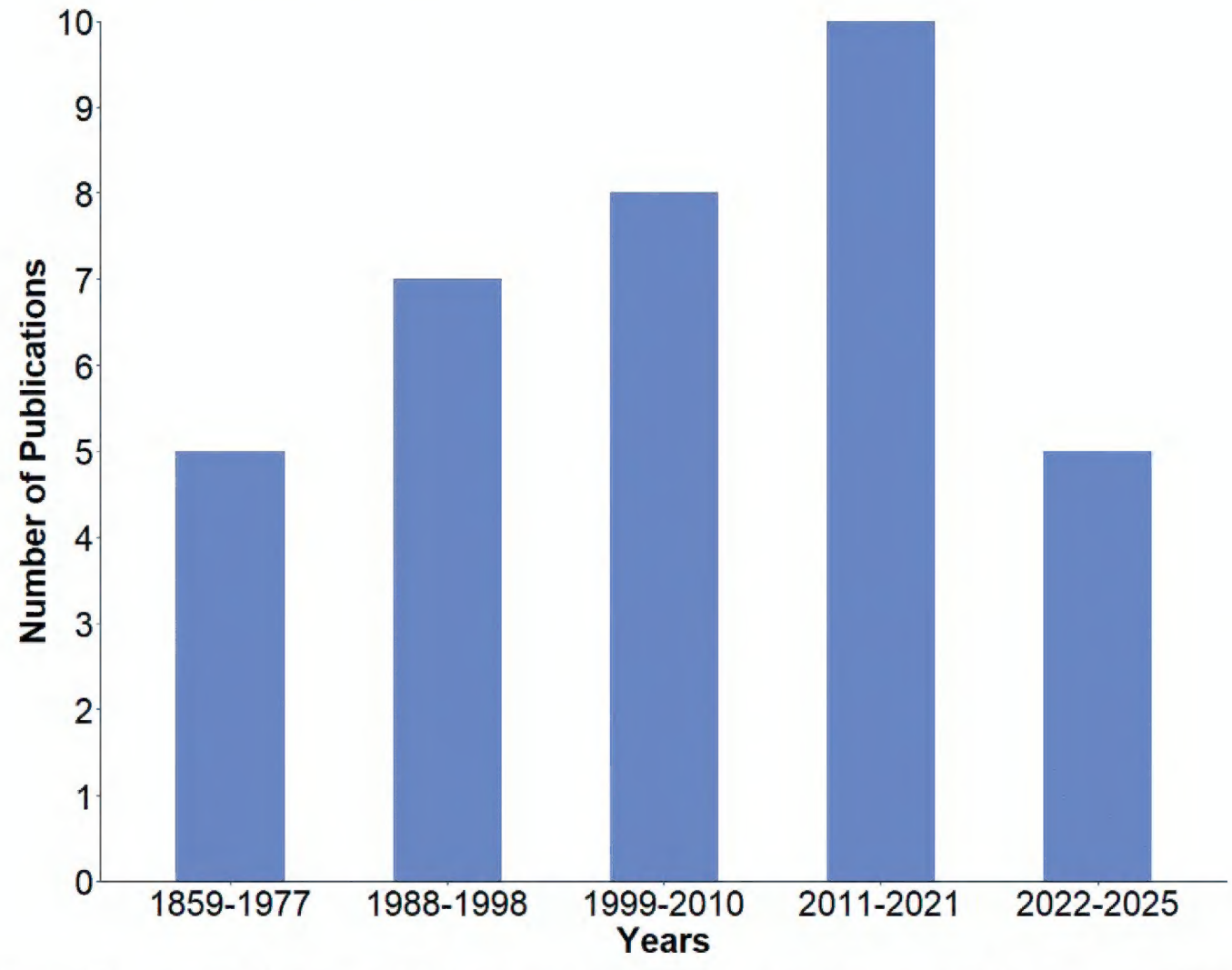

Figure 1. Temporal trend of the number of publications concerning rotifer studies in Peru.

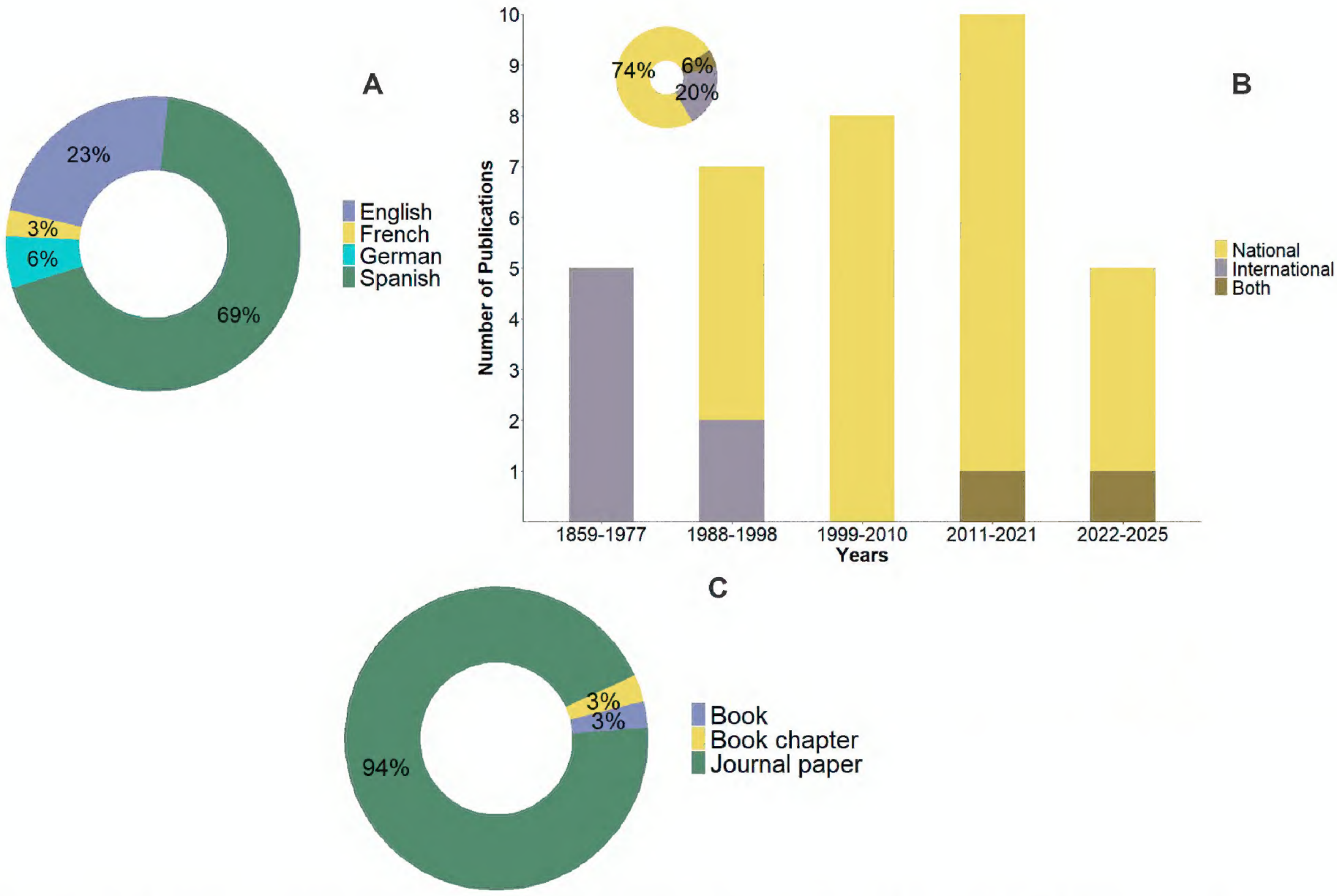

Figure 2. Publications by **A.** Language; **B.** Institutional category; **C.** Type of publication on rotifers from Peru.

Based on the ecological scope of each publication, only a few studies have focused on a single rotifer species (Fig. 3A). In contrast, the majority have examined entire zooplankton communities, including rotifers as one component. A smaller proportion of studies have specifically targeted the entire rotifer communities (Fig. 3B). Additionally, it is important to highlight that all studies were short-term duration.

Checklist of species

The annotated checklist of species, based on the literature search (Suppl. material 1), resulted in 512 records of rotifers in Peru, corresponding to 203 valid species (187 monogononts and 16 bdelloids) (Table 1, Suppl. material 2). All recorded taxa were reported from inland water bodies (Fig. 4). Most species exhibit a worldwide distribution, while only 13 (6%) have a Neotropical distribution (Table 1). No endemic or invasive species in Peru were identified.

Nearly half of the total recorded species for the country come from the department of Huánuco (47%), followed by significant proportions from Ucayali (34%), Loreto (35%), Madre de Dios (34%), and Puno (26%). In contrast, other departments show notably fewer records, such as Lima (12%), Cusco (12%), Junín (4%), and Callao and Ica (1%) (Fig. 4).

Rotifer species from Peru are represented in 25 families and 52 genera. Most rotifer species belong to the families Brachionidae (6 genera with 38 species, 19%), Lecanidae (1 genera with 36 species, 18%) and Notommatidae (5 genera with 19 species, 9%). The most diverse and frequently reported genera are *Lecane* (36 species) and *Brachionus* (22 species) (Table 1).

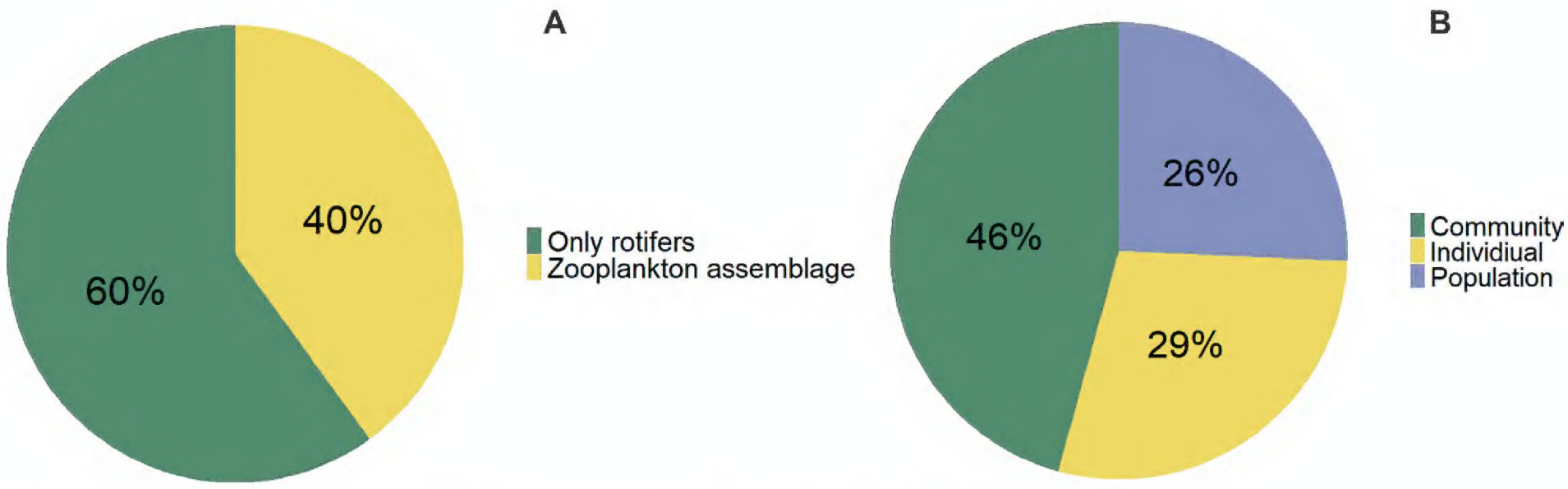

Figure 3. A. Primary group; **B.** Organization level focusing in publications on rotifers from Peru.

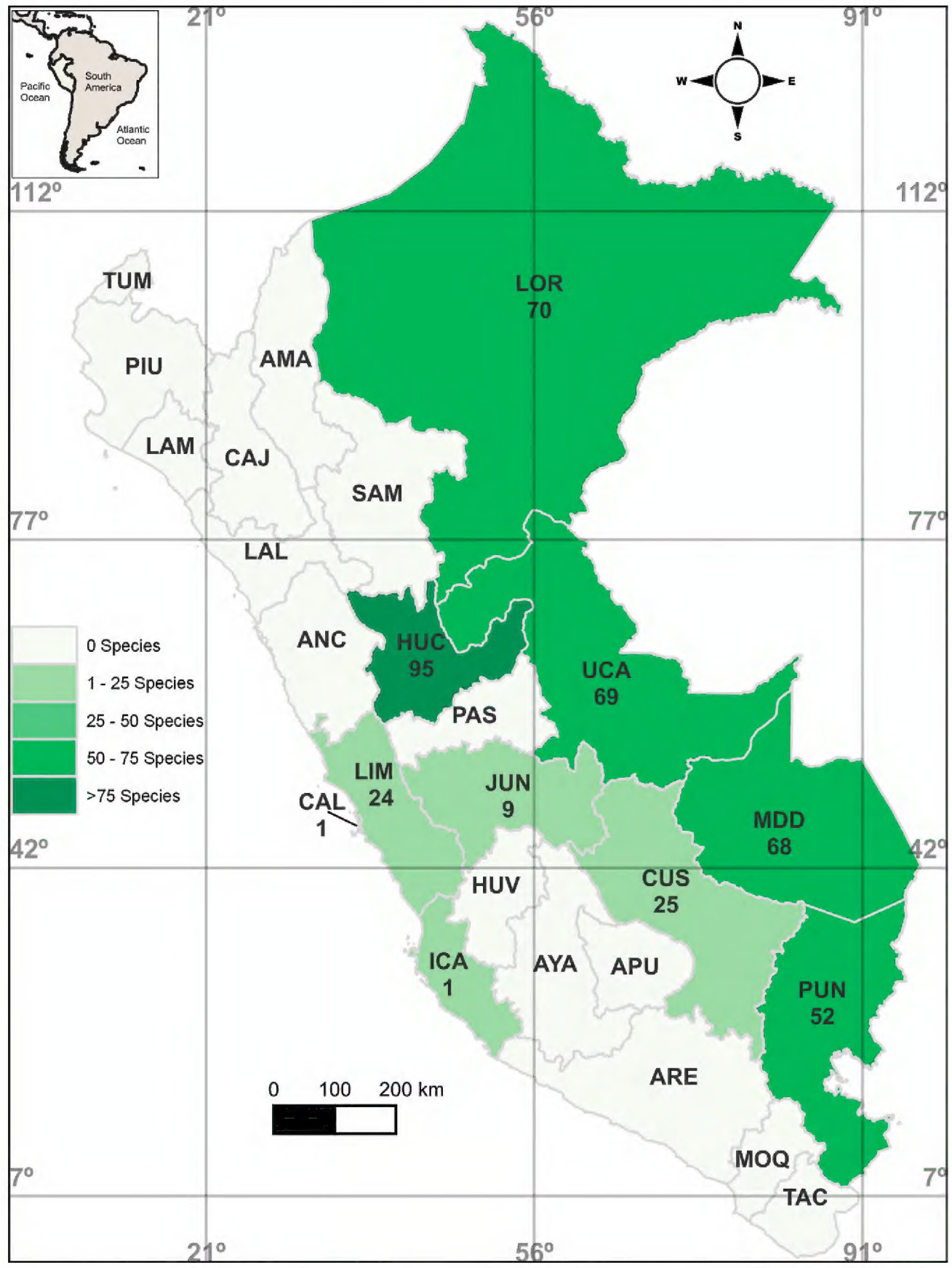

Figure 4. Locations and number of rotifer species recorded from each department of Peru. **AMA** Amazonas **ANC** Ancash **APU** Apurímac **ARE** Arequipa **AYA** Ayacucho **CAJ** Cajamarca **CAL** Callao **CUS** Cusco **HUV** Huancavelica **HUC** Huánuco **ICA** Ica, **JUN** Junín **LAL** La Libertad **LAM** Lambayeque **LIM** Lima **LOR** Loreto **MDD** Madre de Dios **MOQ** Moquegua **PAS** Pasco **PIU** Piura **PUN** Puno **SAM** San Martin **TAC** Tacna **TUM** Tumbes **UCA** Ucayali.

Table 1. List of rotifer species recorded in Peru. For abbreviations, see Fig 4.

Species	Department
Subclass Bdelloidea Hudson, 1884	
Order Philodinida Melone & Ricci, 1995	
Family Habrotrochidae	
1. *Habrotrocha angusticollis* (Murray, 1905)	PUN, HUC
Family Philodinidae Ehrenberg, 1838	
2. *Ceratotrocha cornigera* (Bryce, 1893)	PUN
3. *Dissotrocha aculeata* (Ehrenberg, 1830)	HUC, LOR, UCA, MDD
4. *Dissotrocha macrostyla* (Ehrenberg, 1838)	HUC
5. *Macrotrachela habita* (Bryce, 1894)	CUS
6. *Macrotrachela multispinosa* Thompson, 1892	CUS
7. *Macrotrachela musculosa* Milne, 1886	CUS
8. *Macrotrachela papillosa* Thompson, 1892	CUS, PUN
9. *Macrotrachela plicata* (Bryce, 1892)	PUN
10. *Philodina acuticornis* Murray, 1902	PUN, JUN, LIM
11. *Philodina megalotrocha* Ehrenberg, 1832	HUC
12. *Pleuretra triangularis* Murray, 1913 *	PUN
13. *Rotaria neptunia* (Ehrenberg, 1830)	HUC, LOR, UCA, MDD
14. *Rotaria rotatoria* (Pallas, 1766)	PUN, HUC
15. *Rotaria tardigrada* (Ehrenberg, 1830)	HUC
16. *Rotaria tridens* (Montet, 1915)	HUC
Subclass Monogononta Plate, 1889	
Order Collothecaceae Harring, 1913	
Family Collothecidae Harring, 1913	
17. *Collotheca campanulata* (Dobie, 1849)	HUC
18. *Collotheca ornata* (Ehrenberg, 1830)	PUN, HUC
Order Flosculariaceae Harring, 1913	
Family Conochilidae Harring, 1913	
19. *Conochilus dossuarius* Hudson, 1885	HUC
20. *Conochilus unicornis* Rousselet, 1892	PUN
Family Flosculariidae Ehrenberg, 1838	
21. *Beauchampia crucigere* (Dutrochet, 1812)	HUC
22. *Floscularia ringens* (Linnæus, 1758)	HUC
23. *Limnias ceratophylli* Schrank, 1803	HUC
24. *Limnias melicerta* Weisse, 1848	HUC
25. *Ptygura beauchampi* Edmondson, 1940	HUC
26. *Ptygura crystallina* (Ehrenberg, 1834)	HUC
27. *Ptygura longicornis* (Davis, 1867)	LIM
28. *Ptygura melicerta* Ehrenberg, 1832	HUC
29. *Ptygura wilsonii* (Anderson & Shephard, 1892)	UCA, LOR
30. *Sinantherina ariprepes* Edmondson, 1939	LOR
31. *Sinantherina semibullata* (Thorpe, 1889)	LOR, MDD
32. *Sinantherina spinosa* (Thorpe, 1893)	LOR
Family Hexarthridae Bartoš, 1959	
33. *Hexarthra bulgarica* (Wiszniewski, 1933)	LIM
34. *Hexarthra fennica* (Levander, 1892)	PUN
35. *Hexarthra intermedia* (Wiszniewski, 1929)	LOR, MDD
36. *Hexarthra mira* (Hudson, 1871)	UCA
Family Testudinellidae Harring, 1913	
37. *Pompholyx complanata* Gosse, 1851	PUN

Species	Department
38. *Pompholyx sulcata* Hudson, 1885	PUN
39. *Testudinella ahlstromi* Hauer, 1956	UCA
40. *Testudinella incisa* (Ternetz, 1892)	HUC
41. *Testudinella mucronata* (Gosse, 1886)	PUN, UCA
42. *Testudinella mucronata haueriensis* Gillard, 1967 *	HUC, UCA, LOR, MDD
43. *Testudinella ohlei* Koste, 1972 *	LOR, UCA, MDD
44. *Testudinella patina* (Hermann, 1783)	PUN, HUC, UCA, MDD, LOR
Family Trochosphaeridae Harring, 1913	
45. *Filinia longiseta* (Ehrenberg, 1834)	HUC, UCA, LOR, LIM
46. *Filinia opoliensis* (Zacharias, 1898)	UCA, LOR, MDD
47. *Filinia pejleri* Hutchinson 1964	UCA, LOR, MDD
Order Ploima Hudson & Gosse, 1886	
Family Asplanchnidae Eckstein, 1883	
48. *Asplanchna girodi* Guerne, 1888	CUS
49. *Asplanchna priodonta* Gosse, 1850	LOR, UCA, MDD, LIM
50. *Asplanchna silvestrii* Daday, 1902	PUN
51. *Asplanchnopus multiceps* (Schrank, 1793)	PUN
Family Brachionidae Ehrenberg, 1838	
52. *Anuraeopsis fissa* (Gosse, 1851)	HUC, LOR, MDD
53. *Anuraeopsis navicula* Rousselet, 1911	MDD, UCA
54. *Brachionus ahlstromi* Lindeman, 1939	UCA
55. *Brachionus angularis* Gosse, 1851	LOR, LIM
56. *Brachionus austrogenitus* Ahlstrom, 1940 *	LOR
57. *Brachionus bennini* Leissling, 1924	UCA, LOR, MDD
58. *Brachionus bidentatus* Anderson, 1889	PUN
59. *Brachionus calyciflorus* sl Pallas, 1766	PUN, UCA, LOR, LIM
60. *Brachionus caudatus* Barrois & Daday, 1894	UCA, LOR
61. *Brachionus dimidiatus* Bryce, 1931	JUN, LIM
62. *Brachionus dolabratus* Harring, 1914 *	UCA, LOR, MDD
63. *Brachionus falcatus* Zacharias, 1898	UCA, LOR, MDD
64. *Brachionus gessneri* Hauer, 1956 *	LOR
65. *Brachionus havanaensis* Rousselet, 1911	LOR
66. *Brachionus ibericus* Ciros-Pérez, Gómez & Serra, 2001	LIM
67. *Brachionus koreanus santodomingensis* Sanchez-Davila & al., 2021	ICA
68. *Brachionus mirabilis* Daday, 1897	HUC, LOR, UCA, MDD
69. *Brachionus mirus* Daday, 1905 *	UCA, LOR, MDD
70. *Brachionus paranguensis ventanillensis* Sanchez-Davila & al., 2021	CAL
71. *Brachionus plicatilis* sl Müller, 1786	LIM
72. *Brachionus quadridentatus* Hermann, 1783	PUN, HUC, UCA, LOR, MDD, LIM
73. *Brachionus urceolaris* Müller, 1773	PUN, LIM
74. *Brachionus variabilis* Hempel, 1896	PUN
75. *Brachionus zahniseri* Ahlstrom, 1934	UCA, LOR, MDD
76. *Keratella americana* Carlin, 1943	UCA, LOR, MDD
77. *Keratella cochlearis* (Gosse, 1851)	CUS, HUC, UCA, LOR, MDD, JUN, LIM, PUN
78. *Keratella lenzi* Hauer, 1953	UCA, LOR, MDD
79. *Keratella quadrata* (Müller, 1786)	CUS, LOR, PUN,
80. *Keratella tecta* (Gosse, 1851)	CUS, PUN
81. *Keratella testudo* (Ehrenberg, 1832)	LIM
82. *Keratella tropica* (Apstein, 1907)	PUN, HUC, LOR, MDD, LIM
83. *Keratella valga* (Ehrenberg, 1834)	MDD
84. *Notholca striata* (Müller, 1786)	LOR

Species	Department
85. *Notholca walterkostei* José de Paggi, 1982	PUN, CUS
86. *Plationus patulus* (Müller,1786)	HUC, UCA, LOR, MDD
87. *Plationus patulus macracanthus* (Daday, 1905)	HUC, UCA, LOR, MDD
88. *Platyias leloupi* Gillard, 1957	LOR, UCA, MDD
89. *Platyias quadricornis* (Enhrenberg, 1832)	HUC, UCA, MDD, LOR, JUN
Family Dicranophoridae Harring, 1913	
90. *Dicranophoroides caudatus* (Ehrenberg, 1834)	HUC
91. *Dicranophorus epicharis* Harring & Myers, 1928	HUC
92. *Dicranophorus forcipatus* (Müller, 1786)	HUC
93. *Encentrum saundersiae* (Hudson, 1885)	PUN
Family Epiphanidae Harring, 1913	
94. *Epiphanes clavulata* (Ehrenberg, 1831)	HUC
95. *Epiphanes macroura* (Barrois & Daday, 1894)	UCA, LOR, HUC, MDD, LIM
96. *Epiphanes senta* (Müller, 1773)	PUN, LIM
97. *Mikrocodides chlaena* (Gosse, 1886)	HUC
Family Euchlanidae Ehrenberg, 1838	
98. *Beauchampiella eudactylota* (Gosse, 1886)	HUC, UCA, MDD
99. *Dipleuchlanis propatula* (Gosse, 1886)	HUC, UCA, MDD, LOR,
100. *Euchlanis dilatata* (Ehrenberg, 1832)	UCA, HUC, LOR, MDD, LIM, PUN
101. *Euchlanis incisa* Carlin, 1939	HUC
102. *Euchlanis lyra* Hudson, 1886	HUC
103. *Euchlanis parva* Rousselet, 1892	PUN
104. *Euchlanis pyriformis* Gosse, 1851	PUN
105. *Euchlanis semicarinata* Segers, 1993	CUS
Family Gastropodidae Harring, 1913	
106. *Ascomorpha saltans* Bartsch, 1870	PUN
Family Ituridae Sudzuki, 1964	
107. *Itura aurita* (Ehrenberg, 1830)	HUC
Family Lecanidae Remane, 1933	
108. *Lecane aculeata* (Jakubski, 1912)	HUC
109. *Lecane amazonica* (Murray, 1913) *	HUC, LOR, MDD
110. *Lecane bulla* (Gosse, 1851)	CUS, HUC, LOR, MDD, UCA, PUN
111. *Lecane closterocerca* (Schmarda, 1859)	CUS, HUC, PUN
112. *Lecane cornuta* (Müller, 1786)	HUC, UCA, LOR, MDD
113. *Lecane crepida* Harring, 1914	UCA, MDD
114. *Lecane curvicornis* (Murray, 1913)	HUC, LOR, MDD, UCA
115. *Lecane doryssa* Harring, 1914	UCA
116. *Lecane elsa* Hauer, 1931	LOR, UCA, MDD
117. *Lecane ercodes* Harring, 1914	UCA, HUC, MDD
118. *Lecane furcata* (Murray, 1913)	HUC, MDD
119. *Lecane haliclysta* Harring & Myers, 1926	MDD
120. *Lecane hamata* (Stokes, 1896)	CUS, HUC, UCA, LOR, MDD
121. *Lecane inopinata* Harring & Myers, 1926	HUC
122. *Lecane leontina* (Turner, 1892)	UCA, LOR, MDD, JUN, LIM
123. *Lecane levistyla* (Olofsson, 1917)	UCA
124. *Lecane ludwigii* (Eckstein, 1883)	LOR, UCA, MDD
125. *Lecane luna* (Müller, 1776)	CUS, HUC, LIM, PUN
126. *Lecane lunaris* (Ehrenberg, 1832)	CUS, PUN, LOR, HUC, MDD, JUN, LIM
127. *Lecane marchantaria* Koste & Robertson, 1983 *	HUC
128. *Lecane monostyla* (Daday, 1897)	UCA, MDD, JUN, LIM
129. *Lecane nana* (Murray, 1913)	PUN

	Species	Department
130.	*Lecane nodosa* Hauer, 1938	UCA
131.	*Lecane opias* (Harring & Myers, 1926)	PUN
132.	*Lecane papuana* (Murray, 1913)	HUC, UCA, LOR, MDD
133.	*Lecane pertica* Harring & Myers, 1926	LOR, MDD
134.	*Lecane proiecta* Hauer, 1956 *	LOR, UCA, MDD
135.	*Lecane pumila* Rousselet, 1906	PUN
136.	*Lecane pyriformis* (Daday, 1905)	CUS, PUN, HUC
137.	*Lecane quadridentata* (Ehrenberg, 1830)	HUC, UCA, LOR, MDD
138.	*Lecane remanei* Hauer, 1964 *	MDD
139.	*Lecane rugosa* (Harring, 1914) *	UCA
140.	*Lecane stenroosi* (Meissner, 1908)	LOR, MDD
141.	*Lecane stichaea* Harring, 1913	HUC
142.	*Lecane styrax* (Harring & Myers, 1926)	UCA
143.	*Lecane wulferti* Hauer, 1956	HUC
Family Lepadellidae Harring, 1913		
144.	*Colurella adriatica* Ehrenberg, 1831	UCA, LOR, MDD, PUN
145.	*Colurella obtusa* (Gosse, 1886)	LOR, MDD
146.	*Colurella uncinata* (Müller, 1773)	CUS, HUC, LIM, PUN
147.	*Colurella uncinata bicuspidata* (Ehrenberg, 1830)	PUN
148.	*Lepadella acuminata* (Ehrenberg, 1834)	HUC
149.	*Lepadella amphitropis* Harring, 1916	UCA, HUC
150.	*Lepadella costata* Wulfert, 1940	LOR, HUC
151.	*Lepadella donneri* Koste, 1972 *	HUC, UCA, MDD
152.	*Lepadella elongata* Koste, 1992	PUN
153.	*Lepadella latusinus* (Hilgendorf, 1899)	LOR
154.	*Lepadella ovalis* (Müller, 1786)	CUS, HUC, MDD, UCA, LOR
155.	*Lepadella patella* (Müller, 1773)	CUS, PUN, HUC, MDD, UCA, LIM
156.	*Lepadella patella oblonga* (Ehrenberg, 1834)	UCA
157.	*Lepadella quadricarinata* (Stenroos, 1898)	UCA, MDD
158.	*Lepadella rhomboides* (Gosse, 1886)	CUS, HUC
Family Lindiidae Harring & Myers, 1924		
159.	*Lindia torulosa* Dujardin, 1841	PUN
Family Mytilinidae Harring, 1913		
160.	*Mytilina bisulcata* (Lucks, 1912)	LOR
161.	*Mytilina michelangellii* Reid & Turner, 1988	MDD
162.	*Mytilina mucronata spinigera* (Ehrenberg, 1830)	LOR
163.	*Mytilina trigona* (Gosse, 1851)	MDD
164.	*Mytilina unguipes* (Lucks, 1912)	LOR, MDD
165.	*Mytilina ventralis* (Ehrenberg, 1830)	HUC, LOR, UCA, MDD
Family Notommatidae Hudson & Gosse, 1886		
166.	*Cephalodella boettgeri* Koste, 1988	HUC
167.	*Cephalodella catellina* (Müller, 1786)	PUN
168.	*Cephalodella forficula* (Ehrenberg, 1830)	HUC, PUN
169.	*Cephalodella gibba* (Ehrenberg, 1830)	CUS, PUN, HUC
170.	*Cephalodella gigantea* Remane, 1933	HUC
171.	*Cephalodella gracilis* (Ehrenberg, 1830)	PUN, HUC
172.	*Cephalodella hollowdayi* Koste, 1986 *	HUC, LOR, UCA, MDD
173.	*Cephalodella mucronata* Myers, 1924	HUC
174.	*Cephalodella panarista* Myers, 1924	HUC
175.	*Enteroplea lacustris* Ehrenberg, 1830	HUC
176.	*Monommata actices* Myers, 1930	UCA

	Species	Department
177.	*Monommata grandis* Tessin, 1890	HUC
178.	*Monommata maculata* Harring & Myers, 1930	HUC
179.	*Notommata aurita* (Müller, 1786)	HUC
180.	*Notommata collaris* Ehrenberg, 1832	HUC
181.	*Notommata copeus* Ehrenberg, 1834	HUC
182.	*Notommata glyphura* Wulfert, 1935	HUC
183.	*Notommata voigti* Donner, 1949	CUS
184.	*Resticula melandoca* (Gosse, 1887)	HUC
Family Proalidae Harring & Myers, 1924		
185.	*Proales decipiens* (Ehrenberg, 1830)	HUC
186.	*Proales theodora* (Gosse, 1887)	CUS
Family Scaridiidae Manfredi, 1927		
187.	*Scaridium longicauda* (Müller, 1786)	HUC
Family Synchaetidae Hudson & Gosse, 1886		
188.	*Polyarthra dolichoptera* Idelson, 1925	PUN
189.	*Polyarthra remata* Skorikov, 1896	HUC
190.	*Polyarthra vulgaris* Carlin, 1943	PUN, LOR, HUC, MDD, UCA
Family Trichocercidae Harring, 1913		
191.	*Trichocerca bicristata* (Gosse, 1887)	HUC, UCA, LOR, MDD, JUN
192.	*Trichocerca braziliensis* (Murray, 1913)	HUC
193.	*Trichocerca chattoni* (Beauchamp, 1907)	LOR, HUC, UCA, MDD
194.	*Trichocerca dixonnuttalli* (Jennings, 1903)	HUC
195.	*Trichocerca mucosa* (Stokes, 1896)	UCA
196.	*Trichocerca rattus* (Müller, 1776)	PUN
197.	*Trichocerca similis* (Wierzejski, 1893)	HUC
198.	*Trichocerca similis grandis* Hauer, 1965	UCA, LOR, MDD
199.	*Trichocerca tenuior* (Gosse, 1886)	HUC
200.	*Trichocerca tigris* (Müller, 1786)	HUC, MDD
Family Trichotriidae Harring, 1913		
201.	*Macrochaetus sericus* (Thorpe, 1893)	LOR, UCA, MDD
202.	*Trichotria tetractis* (Ehrenberg, 1830)	LOR, HUC, UCA
203.	*Trichotria pocillum* (Müller, 1776)	CUS

* Species with only Neotropical distribution.

Discussion

The number of publications on Peruvian rotifers is limited, with only 35 studies available. However, not all of these were useful for compiling a reliable checklist of taxa (as can be seen in Suppl. material 1), as some only provided general ecological information without precise species identification.

First referenced data dates back to the 19th century, while classical descriptive studies emerged in the 20th century with significant advancements from the 1980's decade until the present, a pattern frequently observed in rotifer and zooplankton research across other countries in the Neotropical region (Aoyagui and Bonecker 2004; González et al. 2023; Castilho-Noll et al. 2023; Fernández et al. 2024). Short-term ecological studies predominate the literature on Peruvian rotifers, overshadowing classical taxonomic research. Although many natural freshwater ecosystems remain understudied, the number of environments reviewed encompasses all aquatic habitats listed in the Peruvian national ecosystem catalog (MINAM, 2019) and documents rotifer diversity in less-stud-

ied areas, such as bogs, vernal pools, and ponds. Exploring these ecosystems can reveal a "hidden" diversity, as their structural complexity strongly shapes rotifer assemblages (Ejsmont-Karabin and Karpowicz 2021). Karpowicz et al. (2025) exemplified this by reporting the first Neotropical records of *Notommata voigti* Donner, 1949 and *Macrotrachela musculosa* Milne, 1886 (based on Segers, 2007) from subhabitats not previously considered in the Andean region, demonstrating that Peruvian rotifer fauna remains underrepresented even in relatively well-studied areas.

Most recorded rotifer species in Peru are from freshwater habitats in the eastern regions, particularly near the Amazon Basin, a primary hotspot of the country's biological diversity (Rodríguez and Young 2000). This concentration of records underscores the uneven distribution of available data across the country. Moreover, research on Peruvian rotifer fauna is further constrained by the limited number of specialists in this taxon, which has not only reduced the development of taxonomic studies over time but has also shifted research efforts towards short-term ecological studies. Also, although only a few regions have contributed a comparatively higher number of publications (See Suppl. material 2), most records derive from studies conducted by internationally recognized rotifer specialists (e.g., Koste 1988) and national zooplankton researchers (e.g., Samanez 1988, 1991). This imbalance highlights how the geographic distribution of taxonomy experts constrains the understanding of the rotifer diversity in any country (Fontaneto et al. 2012; Ejsmont-Karabin 2019; López et al. 2025).

The recorded rotifer diversity in Peru represents a small proportion (8%) of all rotifer taxa recorded worldwide (Segers 2007, 2008). Nevertheless, the number of rotifer species is unrepresentative, as over half of the departments lack documented records (Fig. 4). In comparison to the rotifer diversity reported in South America, the number of recorded species from Peru is higher than in countries with smaller territorial areas, such as Uruguay (40 species) (Carballo et al. 2023), Chile (121 species) (De los Ríos-Escalante and Woelfl 2023) and Paraguay (71 species) (Duré et al. 2023). However, it is lower than in other neighboring countries, including Brazil (630 species) (Elmoor-Loureiro et al. 2023), Ecuador (287 species) (López et al. 2020), Colombia (253 species) (Andrade-Sossa et al. 2023) and Bolivia (279 species) (Fernández et al. 2024).

Although our review found no records of invasive species in Peru, some taxa, such as *Kellicottia bostoniensis* (Rousselet, 1908) and *Synchaeta jollyae* (Shiel & Koste, 1993) have already been documented in South America (Negreiros et al. 2012; Oliveira et al. 2019; Gomes et al. 2022; Villabona-González and López-Cardona 2022). These records may represent the initial stage of an invasion process and future occurrences in Peru are likely, given the connectivity of many aquatic environments to the Amazon Basin, which has been proposed as a potential dispersal pathway (Gomes et al. 2022), together with the broad adaptations and environmental tolerance of both species in the Neotropics (Negreiros et al. 2012; Gomes et al. 2022).

Among the neotropical rotifers described for the first time in Peru, *Cephalodella boettgeri* Koste, 1988 and *Pleuretra triangularis* Murray, 1913 have also been recorded in other regions and nearby countries (Krau 1967; Segers and Sanoamuang 2007). Similarly, Sánchez-Dávila et al. (2021) reported one *Brachionus* clade shared by populations from coastal South America, and another cosmopolitan lacking clear phylogeographic relationship. Together,

these findings demonstrate that the taxa originally described from Peru do not represent endemism and highlight the need for future systematic studies to uncover biogeographical patterns, particularly in cryptic species (Bickford et al. 2007).

Although research on other inland water communities, such as fish and macroinvertebrates, is more advanced (Ortega et al. 2012; Arana-Maestre et al. 2021), studies on Peruvian freshwater zooplankton are scarce. This study, together with the cladoceran list compiled by Valdivia-Villar (1988), constitutes one of the few faunistic reviews devoted to this group. This highlights that research in this area remains limited when compared with the more extensive studies conducted in other Neotropical countries (López et al. 2023).

Additionally, although rotifers are often overlooked in biodiversity assessments because their wide dispersal and apparent cosmopolitanism make them seem less informative as biogeographic indicators (Segers 2008), the data presented here provide valuable insights into their distribution in Peru. This contributes to addressing a critical challenge in biological conservation for this country, such as correcting the overestimation of species numbers (Rodríguez and Young 2000; Bax and Francesconi 2019).

Since the regional review by Aoyagui and Bonecker (2004), knowledge of the rotifer fauna in Peru has been poorly documented. Thus, the present paper provides a valuable contribution to understanding Peruvian Rotifera diversity and lays the foundation for future research efforts.

Consequently, based on the available information, the most critical gaps that need to be addressed are as follows: (i) Precise taxonomic revision of existing records, supported by modern molecular tools, given the frequency of cryptic species in rotifers (Papakostas et al. 2016; Walczyńska et al. 2024). (ii) Closer collaboration with leading international taxonomists, together with increased research efforts at national and regional levels, is needed to promote taxonomic harmonization and generate additional benefits through scientific collaboration (Duan 2011; Cheng et al. 2020). (iii) More extensive sampling is required in both well-studied and underexplored regions, employing methodologies for characterizing active (planktonic) and latent forms of rotifers in sediments (Jeppesen et al. 2011).

Recommendations

1. Expand research coverage: Broaden sampling efforts in unexplored Andean, coastal, and Amazonian regions, as well as in rivers, wetlands, limno-terrestrial habitats, and on host-associated rotifers, to reduce pronounced geographical and habitat biases.
2. Strengthen taxonomy: Apply integrative taxonomy to revise existing records and uncover cryptic species, while ensuring alignment with global databases. Special attention should also be given to the largely neglected Bdelloid rotifers.
3. Foster collaboration and capacity-building: Create strong national and regional research networks to counteract the shortage of taxonomists and ensure the formation of new generations of specialists. Such initiatives will also facilitate publishing in international journals, thereby increasing the global visibility and impact of Peruvian Rotifera research.

Acknowledgments

We express our acknowledgments to the Office of the Vice-rector for Research and Innovation (VIDI) and the Deanship of Research of the Escuela Superior Politécnica del Litoral (ESPOL), Ecuador, for supporting our activities and the publication of this paper. Additionally, we thank Jerry Arana-Maestre and Leonardo Mendoza-Carbajal from the Department of Limnology at NHM-UNMSM for their support in providing access to literature.

Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

Use of AI

No use of AI was reported.

Funding

No funding was reported.

Author contributions

Conceptualization (CL); Data curation (ERB; IS); Formal analysis (CL; ERB; LMS); Investigation (CL, ERB); Validation (LMS; MJP; EM; GS; IS); Project administration (CL; ERB); Funding acquisition (CL; PdlR); Supervision (CL); Resources (CL); PdLR); Writing original draft (CL; ERB; LMS; MJP; MK; EM, GS; IS; PdLR) Writting-review and editing (CL, ERB; LMS; MJO; MK; EM; GS; PdLR).

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Data availability

All of the data that support the findings of this study are available in the main text or Supplementary Information.

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Supplementary material 1

List of works resulting from the literature search

Authors: Elian Rojas-Baez, Iris Samanez, Luz Marina Soto, María José Pardo, Maciej Karpowicz, Evangelia Michaloudi, Georgia Stamou, Patricio R. de Los Ríos-Escalante, Carlos López

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Supplementary material 2

Checklist database

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Data type: xlsx

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